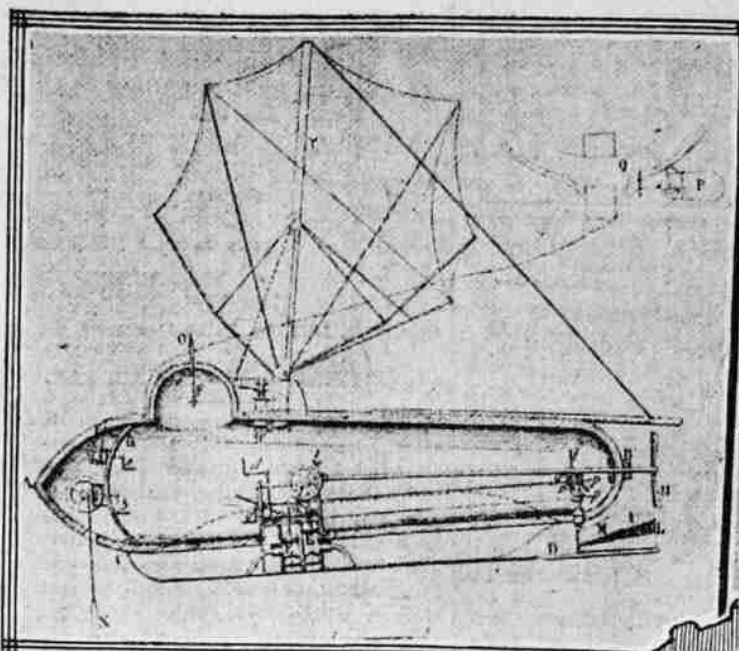
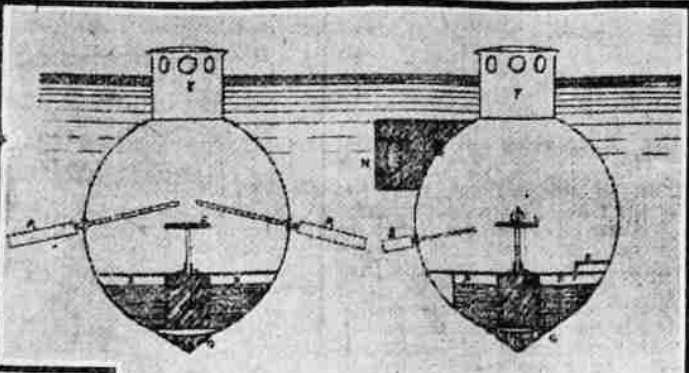
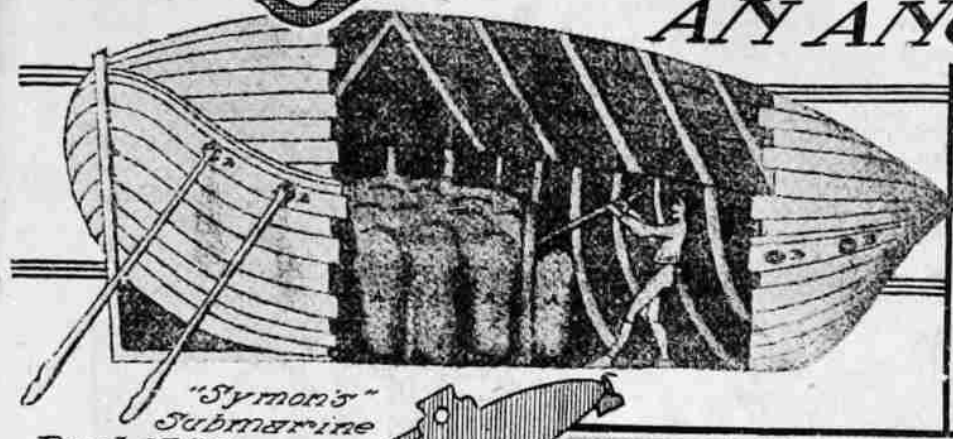


The SUBMARINE

AN ANCIENT CRAFT



"Symon's" Submarine
Boat 1747.
(A) Leather
Bottle for carrying
Water Ballast
(B) Air Apertures
made Watertight
With Leather (From
an old cut in "The
Graphic")

*"The Turtle" (From an old cut
of David Bushnell's
Submarine)*

Robert Fulton's "Nautilus"
(From an old print - 1794)

"The Nautilus"
above and below
water in the harbor
of Brest July 1809. (From
a drawing made by
Robert Fulton.)

Early History of the Most Deadly of Modern Sea Fighters.

(BY L. P. PEYTON.)

THE submarine is a power to be reckoned with in modern warfare. Everyone knows of the almost Herculean feats these under-sea fighters have accomplished in the present conflict.

They have proved beyond all manner of doubt their practicability in actual warfare and they have been hailed as the newest engine of death and destruction. In anything approximating their present degree of perfection they are new, but submarine navigation is centuries old and attempts at it were made before the birth of Christ. Certain old records mentioned an under-sea galley which the Phoenicians invented, but no details are given as to construction, and the date of the invention is unknown.

First Used Diving Bells.

Aristotle is authority for the story that when Alexander the Great laid siege to the Phoenician city of Tyre he used diving bells to get men into the city to start fires. While the apparatus used by Alexander were not submarine boats, they at least showed that the ancients realized the war value of operating under water, and had knowledge of the principles on which the science is founded today.

Another early attempt at submarine work is mentioned by an Arabian historian, Bohaddin, who says that a diver entered the harbor of Ptolemais in 1150 while the city was under siege. Although this man successfully eluded the hostile vessels no details of his apparatus are given by Bohaddin.

The next important step in submarine navigation was made by Cornelius Van Drebel, a Dutch physician who, in 1620, constructed the first actual boat for use under water, of which we have any authentic description. This craft was constructed of wood and was made water tight by greased leather which was stretched tightly over the entire hull.

"She carried twelve rowers besides passengers, and made a journey of several hours at a depth of from 12 to 15 feet. The holes of the oars were made to hold the water by leather joints," is the description given in

*"The Mute" Another of
Robert Fulton's Inventions
(From a drawing
made by himself)*

"New Experiments. Physico, Mechanical," by Robert Boyle, Oxford, 1660.

This boat could not dive and rise like a modern submarine. It crawled along the bottom of the water and as the depth increased finally became submerged.

All the earlier submarines were constructed of wood and it was not until 1634 that Father Mersenne, a monk of the order of Minimes, suggested the use of metal for the hulls. He also declared that the only shape for a submarine boat was that of a fish and that both ends should be spindle shaped so that the vessel could go in either direction.

Guns on the Monk's Submarine.

The proposed manner for firing cannon from the monk's submarine is interesting. There were to be at least two large guns called "Colombiades" at each side of the boat. The muzzles of these were to be pushed hard against hinged lids when ready to fire. Almost simultaneously with the discharge of the cannon the lid was to be raised and with the recoil of the gun would fall into place again before water could enter the boat.

In 1747 an Englishman named Symon, or Simons, made a wooden boat shaped like a galley, large enough to hold two or three men. It was operated by oars and steered by an oar, but his method for sinking and rising was ingenious, though it had been used with little success by Robert almost 100 years before. Along the sides of Symon's boat were a number of leather bottles. When the inventor desired to sink he allowed

water to run into these bottles, the necks of which were of course outside the boat and the bodies inside. When he wished to come to the surface he expelled the water from the bottles by squeezing them and preventing it from flowing back by fastening the necks. Crude as this method was, it is the principle which highly developed, is used in the submarine of today.

Attack on the British.

Very few histories of the War of the American Revolution mention submarines, yet one of these craft was used in an attack on British ships in New York harbor.

David Bushnell, an American, made several successful under-water trips in a copper vessel which, because of its shape, he called "The Turtle." A number of old diagrams of this craft have been preserved.

The Turtle was propelled by oars. The paddle with which she was steered and the other three oars or paddles were of course fitted into air-tight holes. The boat was caused to sink or rise by pumping water into or out of the tanks. It had a conning tower just about large enough for a man's head. The port holes were of glass. Bushnell employed a safety weight. This was a large lump of lead which was to be unscrewed if anything went wrong and the vessel would not rise when the water was pumped out or if the pumps should not work.

She boasted a bomb, or detachable charge of powder, which was to be used to blow in the bottom of a ves-

sel.

Tried to Blow Up a Frigate.

So successful were the trials of the Turtle that the inventor obtained permission from General Parsons to blow up the British frigate Eagle, 64 guns, which was lying with the fleet just north of Staten Island, in New York harbor. As Bushnell was not a recognized belligerent he instructed Sergeant Ezra Lee in the operation of his craft and this gallant officer made the perilous attempt.

At night he was towed by rowboats almost to the Eagle, then sank and managed to work the Turtle under the frigate but it was not possible to fasten the bomb to the copper bottom of the vessel and the tide carried him away.

All thought that Lee had lost his life but after hours of heart-breaking work at the oars he managed to make his way back to the Americans. Meanwhile the bomb had drifted away and exploded where it did no harm except to frighten the crews of several British ships half out of their wits.

The Nautilus.

All this was in 1776. Twenty-four years later another American, Robert Fulton, inventor of the steamboat, produced the most successful submarine boat known up to that time. Napoleon Bonaparte, then first consul of France, had given Fulton 10,000 francs to perfect his invention and the ingenious American had devised a cigar-

shaped craft 21 feet 4 inches long and capable of holding several men. The hull was of copper with ribs of iron and when navigating on the surface it was propelled by a sail fitted to a collapsible mast which folded into a groove when the Nautilus, as she was called, sank.

The Sea Devil.

"Le Diable Marin" (The Sea Devil) was one of the most famous of the nineteenth century submarines. It was the invention of Wilhelm Bauer, who launched it in 1856. This vessel was built of iron. She was 52 feet long, 12 feet wide and 11 feet deep and shaped somewhat like a dolphin. Her sides were six-tenths of an inch thick and could resist the pressure of a 150-foot column of water.

The motive power was provided by a screw which was operated by a treadmill and the up or down motion was achieved by shifting water in longitudinal tanks by means of pistons. At the bow was a bomb or torpedo containing 500 pounds of powder and near it were two heavy India rubber gloves by means of which a man inside the vessel could reach out and fasten the bomb to the bottom or side of a ship.

Remained Long Under Water.

The Russian government supplied him with a crew of thirteen men who were to make a trial trip with him. But on his first descent they were so alarmed as to be useless and when the Diable Marin rose again to the surface they cried, "Staba Bochu," which means, "Praise be to God." When his men were more accustomed to the work Bauer executed many wonderful maneuvers.

The David.

The American Civil War greatly stimulated schemes for submarine navigation, although few practical vessels resulted. The Federal government tested several craft in the Hudson river, but none were of any use. The Confederates did, however, de-

velop a type known from the name of the first of their class as "Davids," which did some effective work. These were technically submarines rather than submarines. The hull was completely under water though a low conning tower which protruded a few inches above the surface enabled the navigator to see where he was steering.

The David, the original of its class, was first tried in Charleston harbor. She was a cigar-shaped craft, manned by Lieutenant Paine and eight volunteers. During her first trip she was sunk by the wash from a steamer and Lieutenant Paine, who was standing near a hatch, was the only man to escape.

Another crew volunteered and Paine again attempted to use the David off Fort Sumter, but she turned over and sank, the lieutenant and two others saving their lives.

The Cooper river was the scene of the next trial and again the vessel sank, drowning nine men. But there were plenty of Confederates brave enough and eager to try it again, and Lieutenant Dixon of the Twenty-first Confederate Infantry and a crew of men who smiled at death, volunteered to sink the Housatonic in Charleston harbor.

On February 17, 1864, the David stole out of the inner harbor by night, and submerged, steamed close to the Housatonic.

A huge torpedo was fastened to a spar in the bow of the David and as the vessel crashed into the Housatonic there was a deafening roar. A column of water reared from the shock, then settled like a water-soaked log and before her consort could send aid, she sank.

It was thought that the David had escaped, but when the wreck of the Housatonic was examined it was learned that the submarine had been sucked into the hole in the side of the larger vessel by the rushing water, and her entire crew of nine men were drowned.

After the Civil War science progressed so rapidly that submarines became more and more practicable. The use of oil as fuel, internal combustion engines, electricity, the use of highly compressed air for the propulsion of projectiles and the perfection of the torpedo all made submarine navigation a reality and an art to be reckoned with in warfare.

Brief History of the Road Which Like the Canal, Was Built (Before the Great Waterway Was Thought of) To Further the Interests of the American.

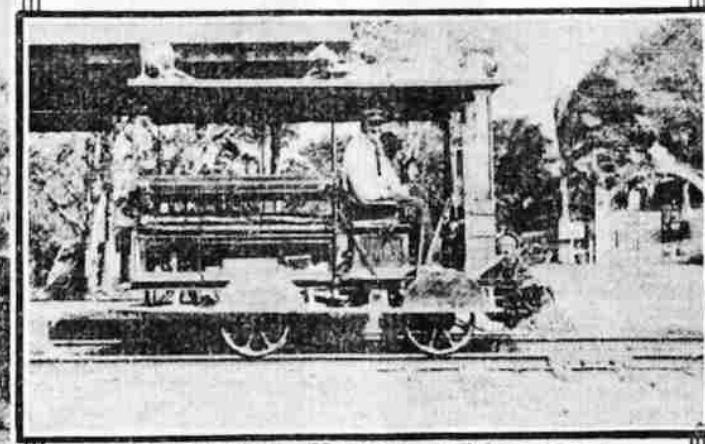
Copyright, 1915, by The International Syndicate.

TWO streaks of rust and the right of way" was the expression used in describing the Panama Railroad when the United States took over the road from the French Canal Company. Seven millions was allowed for the railroad in the Canal deal. It had cost the French Company \$15,000,000.00 twenty-three years before but this was due to the fact that the French were compelled to have the railroad in order to build the canal, for when the Columbian Government granted the Panama Railroad franchise in 1819, they agreed that there should be no other inter-oceanic communication across the Isthmus without the consent of the Panama Company, so the railroad named its own price. But when the United States wanted to buy the French thought best to sell at what was offered, believing that with a canal the railroad would lose in value.

Good Investment.

Aside from its great part in building the Canal the railroad has proved one of the best paying investments the United States has ever had, for in ten years its profits have been some \$15,000,000.00—more than twice the amount paid for it. The right of way has been entirely relocated, for a part of the old road ran through what is now a portion of the Canal and nearly half of the old course now lies at the bottom of Gatun Lake. The relocation cost \$170,000.00 per mile, or \$9,000,000.00 in all. It was completed in 1912 and is an up-to-date, modern railway, heavily loaded, well ballasted and block signal operated. The coaches are of the standard American type. The line runs from Cristobal through the hills where tropical vegetation is so luxuriant that it resembles a huge botanical garden, skirts Gatun Lake, crosses the

The PICTURESQUE PANAMA RAILROAD



The Line Runs Through a Perfect Botanical Garden

An Official Inspection Car

What Sometimes Happens to Dirt Train in the Wet Season

Canal, runs through a concrete tunnel and into picturesque Panama City. All trains are "accommodation" as stops are made at all the stations along the Canal.

Built By Americans In 1849.

The early history of this road is interesting from the fact that like the Canal it was built to further the interests of American citizens and built by Americans after the French had failed. This was many years ago, for the two oceans have been linked by rail since 1855.

The war between the United States and Mexico resulted in a treaty signed on February 2, 1848, which made California a part of the Union. Almost simultaneously with the signing of the treaty gold was discovered in that State and thousands of gold seekers from the east started for the new land. The journey across the country was long and hazardous as the wagon trains were frequently attacked by Indians. The trip to California around Cape Horn was long, expensive and equally dangerous for many of the vessels were unseaworthy and wrecks with great loss of life were a common occurrence.

Trying Days.

A large number of persons went by way of the Isthmus of Panama, shipping from New York on steamers to the Atlantic side of the Isthmus and crossing by trail with pack animals to the Pacific side, where they reshipped to San Francisco. The trail across the Isthmus was only fifty miles in length, but after a time it became even more perilous than the long trip across the States or the sail "around the Horn." The sudden development of the pack-train business on the Isthmus brought a large number of adventurers from South America—Chileans, Peruvians, Indians and mixed breeds. They came solely to plunder and rob, and after obtaining positions as packers, drivers, etc., they began their career of thieving.

As most of the victims were from the United States our Government began to look about for some way of providing the American with a safer mode of travel across the Isthmus. The matter of railroad building was taken up by Congress at the session of 1848-9, and a survey was authorized for the purpose of constructing

a road across the Isthmus. In December of that year three Americans, William Henry Aspinwall, John Lloyd Stephens and Henry Chauncey, obtained a grant from New Granada under the name of the Panama Railway Company. It was merely a modified form of the Klein concession and the

road was to be completed in six years. A few months later the Legislature of the State of New York passed an act incorporating the Panama Railroad Company with a capital stock of one million dollars, with the privilege of increasing it to five million dollars. It also gave the company

the right to begin operations when \$500,000.00 had been subscribed and a certain per cent paid in. The company at once sent Colonel G. W. Hughes and a party of expert engineers to the Isthmus to make a survey for the road. In the meantime they also made a contract with Colonel George M. Totten and John C. Trautwine for the construction of the road. These men were later released from their contract and made associate engineers with Aspinwall and Stephens in the construction of the road built by the company.

It cost Mr. Stephens his life and the other engineers their health. Two of them resigned at the end of the first year owing to a disagreement, but Colonel Totten remained on the Isthmus until the road was completed and went over it on an engine from the Atlantic to the Pacific on the day of its opening, January 23, 1855. The road cost \$5,000,000.00 in money, but it seems that no record was kept of its cost in lives.

The building of the railroad was an engineering feat worthy of the greatest engineer, and without detracting in the least from the glory of the men who built the Canal it

must be acknowledged that the men who built the Panama Railroad deserve far more honor than has ever been given them. During the five years of its construction they were compelled to cut through jungles and morasses which fairly reeked with fever. They worked in a tropical wilderness with sickness and death on every hand. Many times during the rainy season they were compelled to live in the swamps on insect-infested boats. The heat was stifling, and it was with difficulty that the laborers could be induced to continue their work. No army in battle endured greater hardships than these brave Americans who, with an indomitable perseverance, worked against the greatest odds and conquered. There was no commissary at that time, no ice and no pleasant home with screened verandas, shower baths and electric lights. There were no amusements but the dens of vice in Panama, ridden Colon and Panama. There was no Tivoli and no Hotel Washington where the engineers might go for the week-end, yet today one hears little of the pioneers of Panama.

In the old days the fare was twenty-five dollars for fifty miles—fifty cents per mile, yet there was less kicking over this fare than there is today at five cents per mile. In August of 1881 the Panama Railroad sold out to the French Company, and in 1894 came into the possession of the United States.

The length of the new road is a trifle less than the old one. In many places it was necessary to build embankments for the upheavals had to be counterweighted, virtually doubling the width of the foundations. Some idea of the magnitude of the task can be obtained from the fact that one hundred and sixty-seven embankments were built. The three-mile fill across the Gatun Valley alone contains five million cubic yards of material. While this task from an engineering standpoint was greater than the construction of the original road, the present road was built under far different circumstances and with every convenience and comfort the Government could provide.

How this railway aided the building of the Canal by hauling away the excavated material and bringing supplies to workmen is too well known to need repetition here. Suffice to say the Canal could not have been built without the aid of the Panama Railroad.